JPRS 81209

6 JULY 1982

USSR Report

MILITARY AFFAIRS

No. 1685

AVIATSIYA I KOSMONAVTIKA

No. 11, NOVEMBER 1981

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AIR FORCES

FIGHTERS: INTERCEPT TRAINING DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 81 pp 8-9

[Article by Lt Col A. Smetanin, military pilot-sniper: "When the Staff Intervened"]

[Text] The airborne targets flew at different altitudes. Capitalizing on the cover provided by the terrain and maneuvering artfully, they attempted to penetrate to the defended objective under the cover of intensive jamming. But the radar crews discovered them in time. Fighters took off to intercept.

Interacting efficiently with ground command posts in a complex tactical situation, the air warriors assumed an advantageous position for the attack and made accurate strikes. Traces from the targets--radio-controlled practice targets--disappeared one at a time from the screen of the plan position indicator. Not one of them was able to cross into the forbidden area. The mission given to the airmen in the tactical flight exercise was completed. Pilots Lieutenant Colonel Yu. Shuvayev, majors A. Kharchevskiy, A. Yefimov, A. Bedrov and V. Kakhanovskiy and others destroyed their targets with the first missiles.

The success in the air was doubtlessly promoted by meticulous work on the ground. The command and staff of the unit and the political workers implemented a number of measures prior to the exercise. The collective's possibilities were discussed and concrete measures for eliminating certain shortcomings were planned at a command conference and at party and Komsomol meetings in the squadron. Having weighed all of the "pros" and "cons", each airman adopted higher socialist pledges. A careful analysis of the proposals of the communists and Komsomol members and of the pledges they adopted showed that the subunit had reserves it could count on. Were they to be fully realized, the standards could be surpassed by 5-7 percent. On the whole the picture looked pretty good. And the grade the subunit received in the exercise was high.

During a more-detailed critique of the combat flying at the training range, however, it was found that some of the air warriors performed much below their capabilities. This was a sign of trouble to the unit command: The overall high score might give them an incorrect impression of the level of their skills. It would be sufficient to point out that certain pilots in the squadron, which was recently taken over by Major A. Kharchevskiy, reacted badly to remarks concerning mistakes they made during the tactical flight exercise, and they looked at their misfortunes as nothing more than bad luck.

The regiment commander decided to analyze the state of affairs in this collective, which had once been one of the best. He found that the main reason for its less than satisfactory performance lay in improper fulfillment of the combat training plan. Many measures were planned, but not all of them were implemented promptly. The number of unfulfilled items at the end of the week and month was always all too noticeable. And so that the priority tasks could be completed, officers at regiment level were compelled to literally stand in for the squadron leaders and flight commanders, thus barring them from both planning and subordinate instruction. Another important fact was revealed as well. After Major Kharchevskiy was appointed squadron commander, he was justifiably called on the carpet for the low combat readiness and discipline of the subunit, poor political and commander training and much else. They demanded much of him, but they simply forgot to teach the young squadron commander how to correctly organize training and indoctrination.

Having determined the reasons for the poor performance of the subunit, which had invariably maintained an outstanding rating for many years, the unit's staff officers planned concrete measures for providing assistance to the commander. An experienced indoctrinator and teacher who had formerly commanded this squadron, Lieutenant Colonel V. Basov had an excellent knowledge of the people and the traditions of the collective. He tactfully suggested to the young commander how he should establish his relations with subordinates, how he should rely upon communists and Komsomol members to organize the competition and how he should manage the work of the party and Komsomol organizations.

Each airman adopted concrete pledges. When it came time to summarize the results in the groups and flights and in the subunit as a whole, the officers began systematically comparing the successes of the competitors, and evaluating the labor of the men objectively. The wall newspaper regularly carried stories about the best experiences. The success of each pilot, technician and mechanic was brought to the awareness of all. The party and Komsomol organizations waged a more-decisive struggle to make the communists and Komsomol members more active. Cases of carelessness, negligence and deviations from the rules of flight service were brought up at meetings of the party bureau and for general discussion. The poor performers were encouraged to improve themselves, and the men began regaining their former confidence. Things improved noticeably, and the squadron once again climbed to the lead.

But Major Kharchevskiy's collective did not become self-satisfied with its achievements, and it continued to work at an increasing pace. When the results of the socialist competition for the winter training period were summarized, it was named among the leaders.

Experience shows that if the regiment command and staff systematically analyze the state of affairs in the subunits, reveal the exact causes of shortcomings and promptly correct the activities of squadron commanders and staff, the work goes on efficiently and smoothly, without air accidents and near-accidents, and the combat and political training plan is fulfilled with high quality.

But what could be done if a squadron fulfills its plans completely, if it works for long periods of time without problems and if it is able to handle all of its assignments but remains far behind the leaders? How could the work be organized so

that a collective in which the flight crews, engineers and technicians have the skills and are able to complete the most complex tasks with high quality would quickly rise to the top? And is this even possible, if in such a subunit the backbone of military service--discipline--is suffering? Practice shows that this is possible. Here is an example.

A squadron commanded by Military Pilot 1st Class Lieutenant Colonel A. Maksimov was considered to be the best in the regiment, at least in terms of the professional skills of the airmen. This collective was given the most complex assignments, which it invariably completed with outstanding quality. With time, however, unfortunate shortcomings began to appear, especially in discipline. There was an obvious paradox here, it seemed: A collective in which discipline was suffering was enjoying better results in combat training than one in which discipline was at a high level. Nevertheless, the subunit was dropping back to last place.

Having discussed the state of affairs in the squadron, the unit command and party committee came to the conclusion that not enough attention was being devoted to the educational role of socialist competition, and that disciplinary practice was incorrectly organized: Only the regiment's executive staff and squadron commanders had anything to do with it. The flight commanders and group chiefs, meanwhile, seemed to avoid the work of maintaining discipline and order.

It would not be superfluous to emphasize that disciplinary practice, if it is managed correctly, has a significant influence on the servicemen's attitude toward their duty. Some of the airmen in Lieutenant Colonel Maksimov's squadron reasoned as follows: "I know my business well and my performance is not any worse than the others. And there is nothing wrong with easing up after hard work." And ease up they did, breaking some of the rules. Officers M. Utrobin and N. Androsov even went as far as drinking too much.

Such a situation cannot be condoned. Various ways that this collective could be helped were suggested at a conference of the staff officers. But on analyzing the situation, the command and the party organizations concluded that the squadron's airmen had the means to correct the situation themselves.

As a start, they held an open party meeting in which Lieutenant Colonel V. Nakonechnyy gave a briefing. The discussion turned out to be principled and businesslike. Airmen joining the debate condemned the behavior of Lieutenant of Technical Service Utrobin and Senior Lieutenant of Technical Service Androsov, and they made suggestions on how to raise the effectiveness of the party and Komsomol organizations. It was important to raise the responsibility of each communist and Komsomol member for both their own results and those of the entire collective, and to make them serve as examples in the performance of military duty. The criticism publicly addressed toward the discipline violators brought on action. They made the right conclusions for themselves.

The staff officers planned and conducted lessons for the squadron executives, in which they studied the statutes of the Disciplinary Code, acquainted the officers with the disciplinary practices of the best subunits, explained how they could make proper use of sanctioned forms of encouragement and moral simulation in daily

activity with the purpose of mobilizing the subordinates to exemplary service, and they thoroughly explained how socialist competition should be organized, how its visuality could be ensured, and how to publicize the best experience. They turned attention to the fact that in addition to naming the winners of the socialist competition when summarizing its results, they should also publicize their work methods.

"Socialist competition is creativity of the masses," emphasized Comrade L. I. Brezhnev at the 26th CPSU Congress. "By its very essence it is based on the high consciousness and initiative of the people. This initiative is precisely what helps us reveal production reserves and place them into motion and to raise the effectiveness and quality of work." The deep meaning behind these words became, to the squadron's airmen, the foundation for organizing the socialist competition. A healthy spirit of rivalry and mutual exactingness of the soldiers also promoted a rise in military discipline. Headed by Communist Yu. Bedrov, the party organization began concerning itself more effectively with all aspects of the life and combat training of the airmen. Things started to improve, and discipline in the subunit grew stronger.

Maintenance of high combat readiness, improvement of the aerial skills of the airmen and achievement of moral, political and psychological maturity are inseparable, and they make up the foundation of a unified military collective. These components are now under constant control. And whenever a problem arises, the command, the party organization and the staff officers of the particular flight promptly intervene. Practice has shown that their effective, active assistance to those that fall behind is simply indispensable. This once again confirms the fact that wherever the staff constantly monitors the pulse of life in the subunits, and wherever it is the first to sense even the slightest arrhythmia in the work cycle, the results are tangibly better. And when it is the first to sense such problems, it must also be the first to evaluate the situation in which the particular deviation occurred and report it to the commander; it must reveal its causes and take prompt appropriate steps to restore firm military order and to raise flight safety and the combat readiness of the crews and squadrons.

11004
CSO: 9144/0603

BOMBERS: TACTICAL TRAINING FOR 'IN-DEPTH' BOMBING DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 81 p 10

[Article by Lt Col V. Naymushin, military pilot 1st class: "Morning Flying"]

[Text] Following the flight critique the regiment commander gave the squadrons their missions for the next day's flight shift.

During the preliminary preparations the crews studied the missions deeply. They had to make a bombing run over targets at operational depth in the "enemy" defenses. The nature of the targets was not yet known. This was not to be told to them until the preflight preparations.

Together with their navigators the pilots studied the tactical situation, plotted it on the map, and calculated the courses and flight profile. In this case each crew determined how to complete its assignment on its own, selecting the best variant. The proposals were carefully discussed, compared and calculated. Data were prepared for integrated use of piloting resources, and different bombing methods were planned in the event of changes in the tactical and weather situation.

Major M. Makarov, the squadron navigator and a top-class specialist who had accumulated a great deal of experience in operating the new weapon system, described how the pilot and navigator should interact while en route, on beginning the bombing run and during the attack itself. He analyzed the mistakes made by navigators who had recently retrained for these airplanes, which were new to this squadron. The problems were basically associated with lack of experience and absence of firm habits in work with the sighting and navigation system on the bombing run. For this reason some of the crews returned to the airfield without dropping their bombs. Experienced pilots shared their ideas on how to evade fighters and antiaircraft fire and how to avoid detection in flight.

Squadron deputy commander Major A. Siplivyy drew up the flight planning table using a complex trainer in accordance with the flying assignments and weather conditions. The crews practiced their actions, turning special attention to the event of failure of systems and machine units. After lessons with the trainer the squadron deputy commander analyzed the mistakes and deviations. On the whole, all of the crews acted competently.

While the flight crews were preparing themselves in the classrooms for the forthcoming flights, the air specialists at the parking pad made their preliminary preparations on the aviation equipment. Squadron deputy commander for the air engineer service Engineer-Major M. Shova organized the work on the airplanes in strict compliance with the planning table. Examples of a conscientious attitude toward responsibilities were demonstrated by Komsomol organization secretary Lieutenant of Technical Service O. Senchenko and aviation equipment service group chief Lieutenant of Technical Service Yu. Chernichenko. The chief of the flight's technical maintenance unit, Lieutenant of Technical Service V. Kravchenko, attentively monitored the work of the technicians. He turned special attention to the young aircraft technicians, he helped them with advice, and when necessary he participated in the work himself, demonstrating how the particular operation had to be performed. Each air specialist distinctly realized that the performance of the equipment, and consequently the success with which the flight crew would complete its combat training missions, depends on the results of his labor. By the end of the work day Engineer-Major Shova reported to the commander that the aviation equipment was ready for flying.

The preliminary preparations were coming to an end. The flight commanders checked the individual readiness of the pilots and navigators for flying, and verified that the crewmembers knew what to do in each phase of the flight. They also checked the courses they plotted and the data they calculated, after which they subjected the flight to group testing. In this flight rehearsal the airmen answered all questions and inputs clearly. The testing showed that the squadron was fully ready for flying.

The sky was overcast in the morning. Gloomy gray clouds floated close to the ground. But the pilot kept a hopeful eye on the sky.

The target data came in during the preflight preparations. Some of the crews were given the assignment of striking "enemy" guided antiaircraft missile batteries, while others were to strike radar stations and control posts. Some corrections had to be made in the calculations to reflect the latest tactical and aerial situation and weather information. By this time the weather improved somewhat. The commander decided to begin the flying. And so, green flares shot up into the sky.

The crew led by Military Pilot 1st Class Captain N. Balakirev took off on its route. The first three legs were flown uneventfully. The bomber was now coming close to the "front line." The pilot performed a fighter evasion maneuver, and then he dropped to low altitude on instruction from the navigator, Captain V. Shekhonin.

The ground raced swiftly beneath the wings. And soon the checkpoint was at hand.

"This is Four Two Zero, request permission to approach," the pilot queried the flight leader at the practice range.

"Permission to approach granted."

The training range came closer and closer. Eyes inspected each nook and cranny of the ground attentively.

"Commander, the target's forward and left," the navigator reported.

Balakirev also noticed the distinctive shape of raised missiles and reported this to the ground.

"Proceed," was the reply.

The bomb drop was just a few seconds away.... The clock ticked with agonizing slowness.

The airplane was on its bombing run. The pilot and navigator worked at maximum concentration. The target strayed slightly from the center. A slight turn, and the cross hairs of the sight lined up exactly with the target.

"Bombs away!"

Performing an antiaircraft missile evasion maneuver, the bomber assumed its return course to the airfield. Meanwhile the airwaves were filled by reports from other crews: "I'm past the first checkpoint...," "Maneuvering...," "I'm on the bombing run...." Each crew was now taking its examination of combat maturity.

After taxiing to the parking pad captains Balakirev and Shekhonin entered the flight recorder room. It was already known from a message transmitted by the flight leader from the practice range that the flight commander's crew had completed its mission successfully. Nevertheless they wanted to see the results of their work at the practice range with their own eyes. The flight recording resources confirmed what they knew: It had been an outstanding bombing run.

When the crews participating in the first sorties returned to the airfield the squadron commander convened the flight crews and briefly analyzed the actions of specific pilots and navigators, and advised them to turn their attention to using all of the sighting and navigation resources in integration. And then the pilots were once again ordered into the sky.

That day, the crews of top-class pilots captains N. Lisitsyn, N. Smekhovskiy and Ye. Filippov completed their flying assignments with an excellent score. On the whole the squadron's flight crews completed their mission successfully. The pilots, navigators, technicians and junior air specialists fulfilled their socialist pledges.

The aerial and tactical skills of the crews rose to a new level. The quality with which the aviation equipment was prepared for flying improved. This was promoted by the meticulous efforts of the crew and subunit commanders and the party and Komsomol activists to nurture high combat and moral-political qualities in the personnel, and a conscientious attitude toward service and combat training.

The aerial, fire and tactical skills of the winged warriors, the high quality maintenance provided to the equiment and accident-free flying are always in the center of attention of the party organization headed by Communist M. Makarov. These issues have been discussed many times at party meetings and at meetings of

the party bureau. The proposals of the communists for improving the organization of training and indoctrination and raising combat readiness always enjoy the full support of the command and all of the squadron's personnel.

Success in the air is born on the ground. A deep understanding of this truth by each airman, awareness of personal responsibility for the overall success, and the unanimity and cohesion of the whole military collective made it possible for the squadron to complete its annual combat and political training plan with high quality.

11004
CSO: 9144/0603

FIGHTERS: NIGHT TACTICAL INTERCEPT TRAINING DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 81 p 15

[Article by Lt Col (Res) D. Rozhkov: "'Your Target, Attack'"]

[Text] The glowing disk of the sun dropped closer and closer to the horizon. Twilight would soon be at hand, and with it, the flying would begin. Specialists of different services made a coordinated, organized effort to prepare the warplanes for take-off. Breaking the silence with thundering afterburners, a pair took off--the weather scouts.

"Altitude two thousand. Weather excellent. Visibility over ten," Captain N. Vakhromeyev reported to the command dispatching point.

"Roger," the flight leader replied.

The weather was in fact good throughout the entire area. There were no signs of hazardous phenomena. This meant that the planning table would be fulfilled. The airmen would rise one more rung in improving their aerial skills.

After the scouting pair landed, the pilots were given brief preflight instructions. Then the chorus of jet engines broke into song. Night flying began.

A supersonic fighter was ready for take-off. Senior Lieutenant R. Mukhamedov was in its cockpit. The officer's assignment was not an easy one: He had to intercept a maneuvering high-altitude target. The pilot had prepared himself well for the combat flight. He devoted special attention to work with the fighter's controls and sighting equipment, and he thought out the actions he would take if the situation grew complex. During his preliminary preparations Mukhamedov and the command post specialists thoroughly analyzed the typical errors made when attacking high-altitude targets, and they reached agreement on what to do in different stages of hunting for, approaching and locking onto the "enemy," and on the order of using the communication channels.

The fighter was now in the air. The combat control officer attentively followed each of the pilot's maneuvers. A bright trace appeared from his airplane on the plan position indicator. Suddenly it veered left: Mukhamedov was turning onto his required course.

The operator bent over his phosphorescent screen. The outcome of the duel in the sky depended to a decisive degree on his proficiency. The farther away the "enemy" is from the restricted zone when he is detected, the more time the interceptor would have to estimate the situation and make the decision to attack the target. At today's speeds and possibilities of the equipment, every second's delay threatens failure of interception. This is well known by both the controllers and the pilots.

Meanwhile the target flew on. The monotonous buzz of the instruments in the command post was disturbed only rarely by reports from the pilots on this assignment.

"I have a target!" operator N. Zorin's voice broke the silence. "Bearing.... Range.... Altitude...."

He had detected a barely noticeable blip right at the edge of the screen. He knows how to correctly orient himself and detect a moving spot in even the most complex radar situations. And this time, having detected the target, Zorin double-checked his discovery, and on making sure that this was in fact an airspace "violator," he transmitted its flight parameters to the intercept controller.

"Zero One Five, right twenty, afterburners," the commands rose to the interceptor. "Target is right of course, range...."

"Roger," the pilot immediately replied.

And once again only the monotonous buzzing of the instruments could be heard in the command post. Meanwhile a fighter, gathering speed hundreds of kilometers from the airfield in the blackness of the night, rushed toward the target intercept point.

Senior Lieutenant Mukhamedov efficiently responded to the instructions of the intercept controller. When so instructed by the command post, he turned his aircraft and assumed the required altitude. His speed increased swiftly. He was almost at twice the speed of sound. But the target screen was still blank.

"Zero One Five, target is above you two thousand," the combat control officer informed him.

The pilot pulled the joystick, and the variometer showed a swift increase in altitude. Suddenly a barely noticeable trace winked and immediately disappeared. Then it appeared again. He tried the IFF.... Yes, it was the "violator"!

"I see the target," the interceptor reported to the command post.

"Your target, attack!" the ground answered.

The electronic blip became clearer and brighter--the fighter was nearing the target. With precise motions of the controls Mukhamedov herded the "enemy" over to the zero bearing line. The range grew less and less. He could lock on now. He pressed the button on the control stick. Flashing brightly, however, the signal dropped leftward and downward. "Missed!"

"Relax, try again," the senior lieutenant told himself. As soon as the conditions for lock-on were right again, he pressed the button. Missed again.

Now the target was to the side of the sight's center. "It's maneuvering!" Mukhamedov deduced. Now he knew why he was unable to lock on.

Forcing the target blip into the center of the ring, the pilot noticed that it was moving leftward and downward. Keeping his cross hairs on it, Mukhamedov followed the "enemy" maneuver. Lock-on! Now his prey was locked inescapably in the ring. Checking the airplane's attitude, the senior lieutenant continued to draw closer. The distance to the target grew less and less, and soon it was within range, but the G-force was too great. Reducing his banking angle, Mukhamedov brought the sighting ring forward and lowered the joystick slightly. His prey slowly approached the cross hairs. Now it was centered. Launch! And immediately the airplane turned away. Out of the corner of his eye the pilot caught a glimpse of the wing lights of the "violator" amid the stars. "I stopped him!" the officer thought joyfully as he reported to the command post.

"This is Zero One Five, I'm coming home."

Assuming his course toward the airfield, Mukhamedov listened to the radio conversations. Reports from other pilots raised to intercept airborne targets filled his headphones.

Illuminated by the lights of cities and villages, the ground slept. My dear, precious country! It is for the sake of your calm and peaceful sleep that this intense work goes on in the night sky. Many airmen such as R. Mukhamedov and N. Zorin are performing their difficult service shoulder to shoulder.

11004
CSO: 9144/0603

PERSONNEL: EFFECTS OF LIVING CONDITIONS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 81 pp 18-19

[Article by Capt M. Esal'nek, squadron deputy commander for political affairs: "Life--An Important Matter"]

[Text] The gusty wind gradually changed its direction, settling to an orientation perpendicular to the landing strip. Its speed fluctuated as well. Hearing this information from the assistant flight leader, Military Pilot 1st Class Major A. Bolotov taxied to the runway, turned his aircraft to the center of the landing strip, increased his engine RPM and, on receiving permission to do so from the flight leader, began his take-off run.

The white dashed center line of the concrete strip transformed into a solid line as the airplane's speed increased. But take-off would not occur until later, after the take-off speed was reached. Hearing from the radio operator-gunner that the left wing landing gear was in the air, the craft commander countered the effect of the side wind and continued his run. The speed increased. The left wing landing gear dropped to the concrete, but then the right rose upward.

Something kept Major Bolotov from focusing his concentration. He controlled the airplane with unaccustomed roughness, sensing unusual sluggishness throughout his whole body and feeling constrained. His thoughts distracted him from the critical moment when an aircraft separates from the landing strip. The airplane must not climb sharply--this would be dangerous for a craft with a high take-off weight. But the craft commander was too busy with his own thoughts to remember this. An anxious command from the flight leader to reduce his angle of climb forced the pilot out of his strange torpid state, to regain his senses and to energetically correct the dangerous error.

Having reached his required altitude and speed, Major Bolotov raised the landing gear and the flaps, and turning control over to his assistant he slumped wearily into his chair, slowly wiping the sweat from his brow. "What's wrong? What happened?" he asked himself, unable to answer his own questions.

Later on the same questions were asked of him during the flight critique by the regiment commander, who has sincerely perplexed: How could such an experienced and well trained pilot make such a gross error? An error which even young pilots make extremely rarely.

A detailed analysis of the cause revealed that the officer had violated his preflight rest schedule. His child was ill at this time. His wife was anxious and irritable. He was not very calm himself either. The nervous situation in the family disrupted his accustomed rhythm of life. And so, Major Bolotov was unable to get proper rest before flying. He came to the airfield broken and depressed. Perhaps the commander should know about this, he thought, but then he figured that everything would turn out all right.

The near-accident was carefully analyzed in the regiment together with all of the flight personnel. The airmen reached the correct conclusions. The most important thing that this incident brought out was that in flight safety, nothing is unimportant, there are no secondary or insignificant factors. And personal relations in the family, complete and active preflight rest and the nervous, mental and emotional state of each member of a flight crew play far from the last role in this area. The pilot's healthy emotional framework depends on many factors. Success in work, good relations with commanders and friends, good health, orderly family life and many other factors often have a significant influence on the pilot's morale and performance.

The intensity and complexity of flying grew noticeably in recent years, and consequently stricter compliance with safety measures is now required, and more demands are placed on the nervous, mental and pscyhophysiological possibilities of the pilot's body. The capability for enduring large loads and the intense pace of flying, and a reserve of "strength" and stability to make it through various unfavorable factors can be maintained for many long years only on the condition that labor and rest are properly organized, that the requirements of the preflight schedule are complied with and that a favorable moral microclimate is maintained not only at work but also off duty, especially in the family.

As we know, the fight for flight safety is a matter of state importance. The squadron command and the party and Komsomol organizations constantly devote considerable attention to it. The concern for flight safety is an integral part of all military service and flying. Rhythmical fulfillment of the flight training plan, proper organization of preliminary and preflight training, constant improvement of the training process, deep knowledge of instructions, manuals and other guidelines, and the technical competency of flight crews, engineers and technicians are all important components of flight safety.

And it is fully understandable why these factors are kept under unweakening attention. It seems to me, however, that one of them--proper organization of personal time--is not considered seriously enough. The way time off is used today is crucial to relieving stress and strengthening the pilot's emotional health.

There are two sides to personal needs--objective and subjective. The subjective side includes availability of cozy and comfortable housing and organization of communal-personal services, trade and medical services. In a word, all without which a person cannot live and work normally. On the subjective side we have the pilot's own capability for maintaining normal relations in the family, organizing his leisure time and rest, caring for his physical fitness and actively and usefully employing his days off.

A favorable atmosphere in the family, the experience of many of our squadron's airmen shows, depends to a great deal on the wife. The sort of family atmosphere she creates, the way she cares for her husband and children, how well organized she is, and the efficiency with which she solves many problems in the home often predetermine the well-being of the home, the mood and the moral microclimate. As an example aircraft commander Major F. Boyko always comes to work alert, refreshed and happy. His wife, Larisa Ivanovna, is a member of the unit's wives' council. A sensitive, sincere, caring woman, she does everything she can to see that her husband gets good rest before flying, and she tries not to distract him with secondary household concerns. She is able to handle all the problems with the children herself. She always awaits the return of her husband from flying with impatience. And we have many such women.

But unfortunately negative examples are encountered as well. A pilot or navigator comes in for flying angry and strained. He cannot concentrate on his work in any way. What's the matter? He quarreled with his wife, it turns out. And it never occurs to that woman that by her actions she causes problems for everyone.

A collective's unity both at work and off duty, and friendly relations between families have great significance. Naturally, good relations are achieved not through excessive familiarity and not on the basis of a fear of embarrassing each other by demanding and asking too much, but rather by a combination of adherence to party principles and maintenance of well-wishing, respectful exactingness. Without this, it would be impossible to create a healthy emotional background.

Relying on the party and Komsomol organizations, the commander of our squadron, Lieutenant Colonel V. Kryuchkov, tries to reinforce trust, mutual respect and mutual assistance in the collective. Warmth, sincerity and sensitivity have become commonplace. This atmosphere is also maintained off duty. We have developed a good tradition--celebrating holidays and special occasions as one big family. For example, the squadron celebrates each new year in almost its full strength. This unifies the collective and lets the people get to know one another better.

And one can imagine the sort of emotional charge that is provided by joint fishing trips! When Mondays roll around, it is pleasant to look at the tanned, young-looking faces of the pilots, navigators and technicians, to feel the charge of alertness and energy emanating from them and to observe how easily and eagerly they prepare for flying.

Military Pilot 1st Class Major A. Divakov, a detachment commander, has spent more than 30 years in the air behind the controls of different types of airplanes. Andrey Mikhaylovich is an instructor pilot, and he has trained 16 aircraft commanders. The officer endures many hours of flying in his aircraft excellently. I would not be mistaken in saying that an active life, a healthy family situation, an interest in fishing and hunting and a desire to spend more time in nature and to be constantly moving help him maintain his enviable performance. This is even in light of the fact that Andrey Mikhaylovich's flight load is sometimes a couple of times greater than that of some young pilots.

Here is another example. Captain V. Tsybeskov is careless about his physical fitness. He rarely visits the athletic field. It is no surprise that the officer

tires quickly, and that as a consequence he makes mistakes in the air. To make matters worse, he is now undergoing basic training in an airplane that is entirely new to him! He experiences considerable nervous, mental and psychophysiological loads. They can be alleviated primarily through active rest and properly organized leisure time. But Tsybeskov cares not for any of this. Just 30 years old, he is clearly inferior to Major Divakov in energy and emotional stability.

Our physicians constantly monitor the health of the pilots. They make sure that they are eating, resting and sleeping properly. The flight crews and technicians have at their disposal a well equipped vacation base located in a picturesque spot, where flight surgeons headed by Lieutenant Colonel of Medical Service G. Turakhanov have created all of the conditions for the airmen's active and complete rest.

But concerned physicians are not enough if flight crews refuse to watch over their own health and show concern for their own flying careers. Unfortunately, this problem has not yet been solved. There are cases in which young pilots find themselves making increasingly more frequent visits to the flight surgeon after serving in a line unit for a year or two after finishing school. Sometimes such pilots even find themselves grounded. Thus in the last 2 years Captain R. Khabibullin and senior lieutenants R. Yunusov and V. Rodionov were forced to part with the sky before even reaching thirty.

Every person has certain capabilities and even talents of which he is sometimes totally unaware. Active participation in artistic creativity helps to reveal them. Creativity relieves stressful loads and imparts an emotional charge before hard and intense work. Moreover, interests bring people closer together. Our officers devote their free time to their favorite occupations--drawing, painting, poetry and music. They hold exhibitions of their art. This helps to reveal people's talents.

Tourism is a good source of alertness and health. Lieutenant colonels V. Kryuchkov and O. Kiselev have become active tourists in our unit. They pursue this interest in their free time and during their leaves.

Flying is becoming increasingly more intensive and stressful. It is a unique, hard occupation abundant with various stressful situations that subject the pilot to excessive nervous, mental and psychophysiological loads. The great responsibility for monitoring the nervous and emotional load experienced by the personnel, upon which flight safety depends to an enormous degree, lays upon the commander and political workers. And the personal life and rest of pilots plays far from the last role. This is an urgent problem, one which, if inadequately addressed, can lead to flying accidents and near-accidents. It must never be ignored.

11004
CSO: 9144/0603

TRANSPORTS: FLIGHT SAFETY AND TECHNICAL SERVICING OF AIRCRAFT DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 81 pp 20-21

[Article by Lt Col R. Poberezhskiy: "Life's Horizons"]

[Text] The transport aircraft settled softly onto the runway. So ended yet another hard and long flight. A little later the crewmembers learned that their actions earned a high score. Meanwhile Lieutenant Colonel O. Repen'ko, who had tested the airmen, immediately conducted an interflight critique. Oleg Dmitriyevich briefly described the work of each airman and noted the successes and shortcomings. There were almost none of the latter, by the way. This means that a new contribution had been made to the piggy-bank of successes with which the personnel are striving to commemorate the year of the 26th CPSU Congress.

The critique came to an end. Now back to headquarters, where important matters also awaited Officer Repen'ko. He attentively looked over various instructions and manuals and other guidelines, he studied them, and he noted down the things he needed to remember. The result of his hard work was a clear, succinct, deeply grounded document reinforced with diagrams and calculations, to be used as a guideline for lessons in depth to be conducted locally, and the appropriate preventive measures.

Lieutenant Colonel O. Repen'ko, an officer of the flight safety service, usually travels on business with another officer of this service, Engineer-Major D. Tsentomirskiy. At such times they complement each other in their inspections of the quality with which flights are organized and conducted and the faithfulness with which the rules of flying are observed; steps to correct any violations revealed are taken locally without delay.

Repen'ko and Tsentomirskiy resemble each other in neither character nor appearance. Their careers have been different as well. But one thing is definitely the same in their approach to the work: a high sense of responsibility for their job--ensuring flight safety. This is evident right from the start, in their preparations to visit a unit. They draw up a detailed plan, leaving no stone unturned, and they prepare for the work in all possible ways. And then their subsequent work proceeds just as meticulously.

Military Pilot 1st Class Repen'ko, who had served at all levels from deputy commander of a transport craft to deputy commander of a unit, and became an officer of the safety service, thoughtfully studies the flight documents and talks with

people with an eye on gaining a clear picture of the true state of affairs in a unit. He attentively checks the correspondence of the planning tables to the skill levels of the crews, he determines how closely the check-out schedule is adhered to, and he does many other things which in the final analysis help to prevent near-accidents in the air. These document inspections, which are said to occur with nauseating frequency, are precisely what help him determine exactly what rules are being violated and in what way. And his deep, firm knowledge of the regulations, orders and instructions and his rich practical experience allow him to suggest good ways to correct mistakes to the executives.

Once Oleg Dmitriyevich noted that some of the aircraft commanders of the unit in which Tsentomirskiy himself once served were overdue for piloting check-outs. The regiment deputy commander tried to make excuses: The pilots were rather well experienced, he argued, and nothing could ever happen. But Repen'ko insisted that they be checked out on the very next flying day.

"That would raise havoc with our plan."

"I'm sure it would," the lieutenant colonel said. "We'll try to help you through. But no one has the right to violate the existing order."

The discovered shortcoming was corrected on Officer Repen'ko's insistence and with his active assistance.

While Repen'ko checks out pilot training, Engineer-Major Tsentomirskiy usually inspects the preparation of aviation and ground equipment, turning special attention to the quality and completeness of all planned jobs. There are many questions to be answered here as well: He must consider not only the preparedness of the airplanes but also how well the flight logistical support is organized, whether or not the technical crews and groups are up to strength and whether or not the specialists are being utilized correctly. In one of the units Lieutenant of Technical Service A. Rozov was appointed unofficial assistant to the garrison commandant , but no replacement was provided for his airplane. The commander ignored the whole issue, believing it to be within the competency of the chief of staff. After hearing Tsentomirskiy's report, Repen'ko pointed out to the commander that concern for discipline and military order should doubtlessly be displayed, but not at the expense of flying and flying safety.

Situations of greater complexity also occur. Inspecting motor vehicles allocated for flight support one day, the safety service officers discovered malfunctions in some of the specialized vehicles, including on a fueling tanker and a tractor. Naturally, those vehicles were immediately sent to the shop.

"We used to permit such vehicles to service the airplanes, and everything seemed to turn out all right," said some of the comrades from the supporting unit, and they expressed their concern: "This could mean cancellation of some flights...."

But Lieutenant Colonel Repen'ko would not budge.

"The time should be spent now not on excuses but on something entirely different--quickly correcting the malfunctions. Let this incident be a lesson to you."

Oleg Dmitriyevich spends a lot of time on prevention. Once while inspecting some technical documents he established that a certain airplane that was intended to fly that day had not undergone its required monthly maintenance and general inspection. The craft was barred from flying until the omissions in its technical maintenance could be corrected. After this work was done, the maintenance crew thought it could relax. But officers Repen'ko and Tsentomirskiy inspected even deeper. As a result they discovered violations in document management and in job accounting. The chief of the detachment's technical maintenance unit was found to blame.

He was punished by the commander. Order was quickly restored. But Lieutenant Colonel Repen'ko did not limit himself to this, suggesting that a demonstration lesson be conducted for specialists on the basis of the experience of a detachment in which the technical maintenance unit is headed by Captain of Technical Service A. Tsybul'ko. This leading officer had been in aviation for more than 25 years, he performs his duties efficiently and accurately, and he maintains documents in exemplary fashion. The benefit from the lesson turned out to be highly tangible. This was even admitted to by the wayward technical maintenance unit chief.

Lieutenant Colonel Repen'ko's job is a troublesome one. There are perpetual visits to the units, and work at headquarters....

"There is plenty of paperwork at headquarters, to be sure," Oleg Dmitriyevich smiled when I mentioned this to him. "You have to know how to analyze each near-accident quickly and correctly and to organize effective preventive steps which would guarantee high flight safety. Such a goal is worth spending all of this time with the relevant paper work. Work and flying experience are a great help to unraveling tricky situations in minimum time."

Once when Oleg was in ninth grade the uncle of a school friend of his--a pilot and a regiment commander--came for a visit. The romantic stories he told and the people he described made it impossible for the young boys to even imagine any career other than aviation.

Repen'ko pursued his goal without vacillation. Ten years later he was in military aviation school; when he finished, he was among the few graduates given a 3d class rating. On joining his regiment he began flying in the copilot's seat in the crew of the detachment commander, Major M. Stremovskiy. The young lieutenant was to the liking of the experienced pilot. He flew with him once, and a second time, and then gave him permission to fly the heavy craft on his own. Although he had clocked a respectable amount of flying hours while at school, at first Repen'ko found his work exhausting: He had to pilot the aircraft attentively, maintain communication and watch over the work of the crewmembers all at the same time.

"Well, what did you expect?" Marat Aleksandrovich egged him on. "If you want to be a commander, you'll have to learn a lot."

He very much wanted to take charge of a crew. Therefore Repen'ko labored persistently, absorbing everything Stremovskiy and other chiefs taught him. He studied diligently as he gained more experience. It was for this reason that he was one of the first among his schoolmates to move over to the pilot's seat. He was 23 years old at that time.

Once Repen'ko found himself in a sticky situation, one which would be difficult even for an experienced pilot, but he worked it out all right. Although that happened long ago, he still remembers it well.

The airmen were scrambled for a mission. It was not a very difficult one, but there were thunderstorms along the route. And almost the entire crew was young and inexperienced. Lieutenant V. Mikhalist, who had arrived from school just 4 months ago, was the navigator. As soon as they reached their required altitude the radar antenna went on the blink. A message from the ground warned them that they were flying right into a thunderstorm. But the mission (delivering a certain cargo) had to be completed.

It seemed to the young commander that he had taken all of the precautionary steps. Perhaps he turned away from the thundercloud a little too late. But even the ground, it was found out after, was late in transmitting the warning. The maximally laden aircraft was tossed from side to side, and the pointers of the instruments swung wildly across the scales. The airplane began losing altitude quickly. Repen'ko managed to resume horizontal flight relatively quickly. Nor did the young navigator lose control. They made contact with the airfield, reported the situation and began climbing back to their altitude.

They completed their mission successfully.

A thorough critique was held after the flight. That the crew and its commander had done the right things was confirmed. This memorable sortie helped persuade Repen'ko one more time how important deep knowledge, firm habits and a well coordinated crew are. And feeling that he still had far to go, Repen'ko tackled his studies even more stubbornly. He received his first class rating. He studied diligently, and later on, when he served as commander of an aircraft, a detachment and then a squadron, he demanded the same from his subordinates.

Once when he was unit deputy commander he was given command of a group of crews that were to do some flying over mountainous terrain for several months. They had to work mainly with dirt landing strips, and radiotechnical equipment was at a minimum. But the people met the difficulties with stubborn labor. They thought out all of their actions down to the finest details. They analyzed each assignment thoroughly, considering all possible variants.

As a rule Oleg Dmitriyevich would check out each new airfield himself before allowing his subordinates to land. Weather in the mountains was variable, and the winds were intense. Repen'ko developed the following landing procedure for a dirt landing strip nested in mountains. On approaching the final checkpoint, he reduced the engine RPM more than usual. The airplane seemed to fall like a rock. But this maneuver made the landing more accurate. There was of course a certain risk, but the threat of an accident never arose: Professional skill, experience, endurance and the cohesion of the crews won out.

Whenever the landing strip was small and they had to land at night, Repen'ko landed first, and then he guided the rest of the group down.

"The darkness was impenetrable, and the only help we got were sparse rows of runway lights that could barely be seen from the air," he recalled.

Describing his flying, Oleg Dmitriyevich drew diagrams of the runways and the way he approached them on sheets of paper lying in a pile on his desk--this was a habit of his, which he had developed over the years. Oleg Dmitriyevich recalled some facts from his career as a cadet and an officer, and his comrades in arms recalled others. The pilots talked about their flying profession proudly. But they also admitted that risks often have to be taken.

That may be true. But the degree of risk may vary. It is for the sake of minimizing this risk that military pilot 1st class Lieutenant Colonel Repen'ko stands guard over the rules of flying. It is in many ways owing to his organizational and preventive work that there have been no accidents or breakdowns for a long period of time in the units which he regularly visits together with other officers, and that the number of near-accidents has decreased.

Communist Repen'ko is a man with a high sense of duty. He has not been overrun by the tidal wave of paperwork, and the horizon of his life has not grown narrower. His concern for reinforcing combat readiness and raising flight safety does not allow him to stagnate in an office. He learns, and he teaches others. And it will not be long before the officer will sit down behind the controls of an airplane new to him, to travel roads yet unknown. It is the obligation of his position: Only an outstanding pilot having a full knowledge of his romantic but difficult profession can fight a real battle for flight safety.

11004
CSO: 9144/0603

FIGHTERS: READERS' QUESTION ON TACTICAL APPLICATION OF FIGHTERS ANSWERED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 81 pp 22-23

[Article by Col V. Belyayev, candidate of military sciences: "Two or One?"]

[Text] Many fighter pilots have no doubts in this regard. A pair is better, to be sure! But more and more specialists are beginning to think today that this question is not as simple as it might appear at first glance. Apparently it could be answered only after deeply analyzing the changes which have occurred in equipment, in tactics and in the viewpoints on combat use of fighters.

The experience of the Great Patriotic War persuasively confirmed that a well coordinated pair of fighters was able to successfully complete many of the missions of frontal fighter aviation. Fighters flew in pairs for reconnaissance and "hunting," they covered troops in pairs, and they supported other arms and branches of aviation, attacked enemy troops and annihilated enemy ground targets in groups of different sizes. But the pair was the basic fire and tactical unit. The loss of a follower or leader in a combat flight was felt to be an extraordinary occurrence which was subjected to careful analysis. Those to blame were strictly punished. The loss of a leader even in training flights was interpreted as a major pilot shortcoming: The pair was law.

But that was not always the case. Prior to the Great Patriotic War and in its first years, a flight of three airplanes was the fire and tactical unit. The flight was basic to the combat formations flown by fighters not only in the Red Army Air Force but also in the armies of many other countries.

Why did the flight of three airplanes lose the competition with the pair? The answer could be found by analyzing the objective conditions and the scientific-technical achievements. As aviation equipment developed, fighter aviation began receiving new airplanes. Their possibilities of maneuver and fire influenced the tactics and views on combat use of fighters.

The main shortcoming of the three-fighter flight lay in the principle upon which the defensive tactics of aerial combat were based: Shifting from flank to flank, the followers covered the leader from attack in the rear hemisphere. In this formation the leader's freedom of maneuver was severely constrained due to the danger of collision with the followers. The leader could not use his engine at full power because his followers needed extra power to maintain their places in formation. Moreover the attention of the pilots was distracted by the need for observing each other and the leader.

The trio did have an advantage--high fire density. This was especially important because of the low power of the armament supplied to I-16, I-153 and I-15 fighters in that era.

At the beginning of the Great Patriotic War Soviet fighter aviation began receiving new models of airplanes possessing powerful cannon and missile armament. One such fighter became equal to three of the previous sort in terms of the power of the onboard armament. Given all of its shortcomings, the three-airplane flight constrained the possibilities of the fighters. The tactics of aerial combat demanded offensive actions and free and energetic maneuvering in the air during reconnaissance and while covering attack aircraft, bombers and ground troops.

The newly created fire and tactical unit--the pair of fighters--satisfied these requirements most fully at that time. It became an indivisible unit, and it remained as such in the minds of many fighter pilots. What are its merits?

First of all the leader was able to calmly attack on airborne or ground enemy without worrying about being attacked in the rear hemisphere. During the war, fighters were usually attacked from the rear hemisphere. To be sure, the term "calmly" is relative, since the leader was doing all of this under combat conditions. Nevertheless the basic formulas of those years, "The follower is the leader's shield!" and "The leader attacks and the follower covers!" expressed the actual responsibilities of each pilot in the pair. The leader always knew, and was certain, that his follower would always cover him from an enemy attack from the rear, because the range of effective fire was always less than the range at which the follower was able to visually determine the presence of an attacking enemy. In aerial combat, the enemy placed priority on destroying the leader, as being the most important target. Whenever the follower assumed the role of attacker, the leader covered him from attack in the rear hemisphere. Performing a mission, the pilots of a pair were always ready for an encounter with the enemy in the air due to the way their combat formation was organized and the mutual support they provided each other in combat.

Second, the fire potential of a pair of fighters making a simultaneous attack was greater than that of a lone airplane. Third, in aerial combat the leader was able to give his follower practical training in tactics, methods of combat and fire. "Do as I do!"--this was the principle according to which the follower was trained in combat sorties. Moreover the leader was able to teach the follower what to do when supporting other branches of aviation and when conducting reconnaissance, he was able to introduce the follower to the regularly flown routes and to reference points along the way, and he could provide assistance in navigating to the home airfield.

Fourth, being able to observe the follower visually, the leader could control him in the air. The design of the fighter and the short distances and intervals in the combat formations of the pair made this possible. Once a pair worked out its coordination, it never broke down into lone airplanes and was able to ensure its own safety.

But pairs also had shortcomings typical of a tactical unit requiring mutual communication. These shortcomings impose various restrictions on the actions a

pair can take in the air: The leader must keep part of his attention on holding his position in the combat formation. In comparison with a lone fighter, the maneuverability of a pair is lower due to the unavoidable lag time in the follower's responses to the leader. The leader's reserve engine power is lower because the follower must be given a power advantage for the purposes of maneuver.

The merits of a pair significantly surpassed its shortcomings.

As scientific-technical progress developed in aviation, fighters of fundamentally new design appeared, ones with armament equal in power to that of several Great Patriotic War airplanes. They carry a large ammunition load, and the onboard detection systems allow the pilot to see the target at ranges dozens of times exceeding the range of visual detection, and to strike unseen targets. Moreover fighters can now use their weapons from considerable range and at large angles of approach.

Improved navigation resources make it possible for a fighter to fly in all weather conditions day and night, and to return to its home airfield alone. Fighters have good helpers on board and on the ground, ones which will always tell the pilot where the enemy is attacking from and determine the rhythm of attack, the range to the enemy and his altitude.

All of these changes compel us to look a little more carefully into the merits and shortcomings of the pair as the fire and tactical unit today, and to evaluate it critically, as had once been done in relation to the three-airplane flight.

Are the actions of a pair the same today? Have its shortcomings decreased, or have they grown in number? An analysis would show that in modern combat the leader is no longer able to calmly attack an airborne or ground target with the assurance that the follower would cover him against enemy attack from the side or rear. The leader, in turn, cannot ensure the safety of the follower from such attack by the enemy. Thus the formula "The follower is the shield of the leader!" has lost its former significance and no longer satisfies the requirements of modern combat.

Now a fighter can annihilate any airborne target on its own with high probability. It stands to reason that the probability of target kill by a pair of fighters is somewhat greater than that of a lone airplane. But calculations and the experience of firing exercises show that this increase in probability is so insignificant that it does not compensate for the shortcomings of the pair. All the more so because the probability of annihilating a target would be greater with two lone fighters than with a pair.

The leader of a pair of modern fighters can no longer demonstrate the procedures of aerial combat and the methods of attack to a follower in the air because of the significant ranges at which missiles are launched, the low density of the combat formations and the considerable airspace within which aerial combat proceeds. In terms of learning reference points and approaching the home airfield, meanwhile, the pilot is aided by his own instruments and the control post.

It has become extremely difficult for the leader to control the follower in the air as well. He can only speculate as to the actual location of his follower.

The modern lone fighter is far from defenseless, while the necessary communication between leader and follower in a pair leaves all of the present shortcomings to contend with, and it even increases them. Thus because the intervals and distances in a pair are considerable, the follower's attention is distracted even more by the need for keeping his position in the formation, and the lag time of his maneuvers increases. This forces the leader to either forewarn the follower of any maneuver (which is not always possible when interference is present) or to limit the intensity with which he maneuvers. Thus another shortcoming is amplified as well--the need for the leader to keep a "reserve" of engine power so that the follower could keep his position in the combat formation, especially when an increase in speed might be required.

It would not be superfluous to note that practical use of modern fighters at night and in clouds has shown that the lone fighter can be thought of, and is now thought of, as the basic fire and tactical unit.

It may be that the time has come to recognize the lone modern fighter as a fire and tactical unit, all the more so because the pair breaks down more and more frequently into lone airplanes during aerial combat, as is confirmed by the experience of recent local wars brought on by imperialist states. This does not at all mean that only one fighter--that is, one fire and tactical unit--would be sent up for every mission. It all depends on the conditions created by the combat situation. I think that this question deserves attention, and that both pilots flying modern airplanes and war veterans will state their opinion in this journal on this regard.

11004
CSO: 9144/0603

FIGHTERS: USE OF ELECTRONIC SIGHTING DEVICES DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 81 pp 22-23

[Article by Col V. Fedorov: "Using Electronoptic Instruments"]

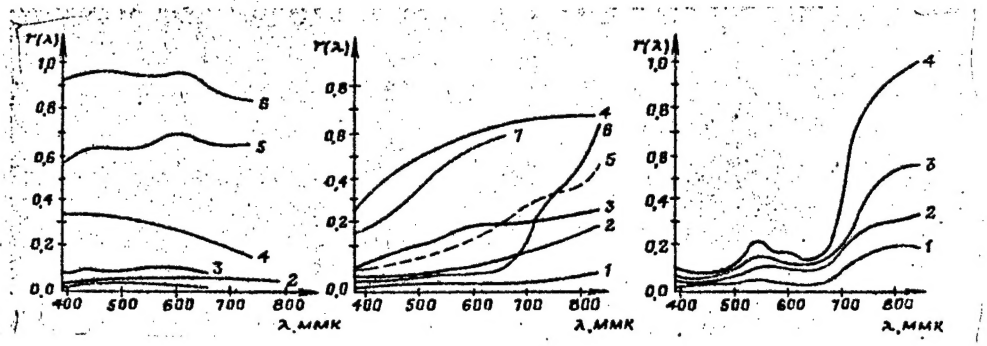
[Text] The term electronoptic is applied to instruments in which the processing of information on an observed object entails transformation of radiant energy into electrical energy. Such instruments are often contained in sighting and navigation complexes, and they are intended for detection and identification of visually observable objects on the ground, and for measurement of their coordinates during the day in fair weather and in the presence of haze.

The possibilities for detecting and identifying objects of various colors and contrast depend on the observation conditions, the resolution and sensitivity of the eyes and the properties of the electronoptic instrument which define its basic characteristics.

Atmospheric conditions have a significant influence on transmission of electromagnetic waves. Short infrared waves (0.76-1.5 μ) in the 0.95-1.05 μ and 1.2-1.3 μ bands are transmitted better than waves in the visible spectrum (0.4-0.76 μ). Owing to this the range at which objects can be detected with the help of electronoptic instruments working in the short infrared wave range must be several times greater than the range of detection with the unaided eye.

Perception of the ground surface depends on its emissive and reflective properties. Reflected radiation consists primarily of solar radiation, and it exceeds intrinsic radiation in the range of wavelengths less than 4 μ. The maximum of solar radiation reaching the ground coincides for practical purposes with the maximum of the eye's spectral sensitivity. The coefficients of reflection of most forms of ground cover within the visible spectrum are relatively constant, while in the infrared range they may vary significantly.

Almost all natural cover may be divided into several groups depending on reflectivity of different spectral bands. The first includes ground cover for which the coefficient of reflection hardly changes with change in wavelength (Figure *a*). The second includes cover for which the coefficient of reflection changes a little with increase in wavelength (Figure *b*). The third includes green plant cover. The coefficient of reflection for this group is approximately constant in the 0.4-0.4 μ range, it has a slight maximum at a wavelength of 0.56 μ and a sharply pronounced minimum at about 0.65 μ, and as the wavelength increases it rises quickly, especially in the infrared portion of the spectrum (Figure *c*).



a) 1--wet chernozem; 2--moist loamy soil; 3--gray granite boulders; 4--ice; 5--thawing snow; 6--fresh show

b) 1-4--average curves for similar forms of objects (from Ye. L. Krinov); 5--damp forest; 6--arid steppe; 7--dry clay

c) 1--conifer forest in winter; 2--conifer forest in summer; 3--deciduous forest in summer; 4--fresh green meadow

Image contrast depends on the properties of the eye and the electronoptic instrument, on the coefficients of reflection of the object and the ground cover and on natural illumination, which itself depends on the time of year and day and on the nature of the cloud cover. Maximum relative spectral sensitivity for the eye is 0.555 μ, while for electronoptic converters working in the near shortwave infrared range it is about 0.8 μ.

The coefficient of reflection of an object depends on the material from which it is made, the form of and the quality with which its surface is worked, and its outer covering. Moreover the reflectivity of the object depends on the position of the sun relative to the former and the observer.

As we can see from the figure, the coefficients of reflection of 0.555 μ and 0.8 μ wavelengths by cover such as ice, arid steppe and especially green plants differ significantly. As a consequence objects observed by means of electronoptic instruments exhibit completely different contrast with the background than do objects observed visually, going as far as a negative contrast. Moreover terrain visible on the instrument screen appears in black and white with different shades of gray; therefore objects are detected on the basis of their shape and the mutual arrangement of their components. Thus the image on the screen of an electronoptic instrument will differ in color and contrast from the image to which the eye is accustomed. This doubtlessly creates certain difficulties in determining the nature of objects with the help of electronoptic instruments. The graphs shown here may be of assistance to pilots and navigators analyzing the properties of ground cover and objects with the purpose of predicting the way they would appear in different natural lighting conditions.

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CSO: 9144/0603

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